RESTRICTED

TM 5-267

SUPPLEMENT 1

WAR DEPARTMENT

TECHNICAL MANUAL

CAMOUFLAGE

June 1, 1943

CAMOUFLAGE

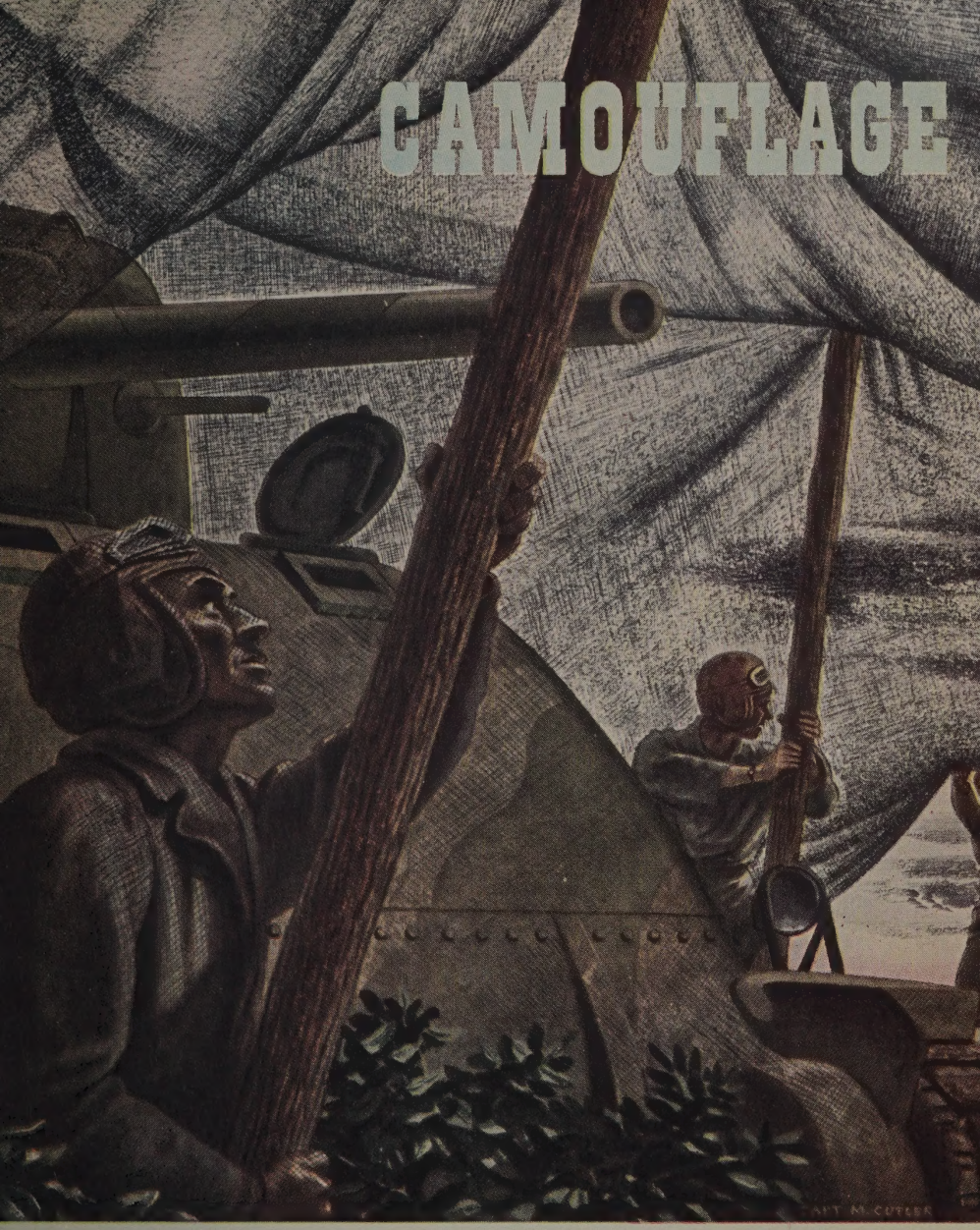

FIGURE 1.—*Concealing tank with shrimp net after night operations. Note fullness of net and use of poles to distort outline.*

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Bombs and torpedoes are dropped, equipment and personnel are strafed, artillery shells are directed accurately to their targets, troop movements and concentrations are studied in detail, campaigns in unfamiliar terrain are planned. All these military activities rely on aerial observation.

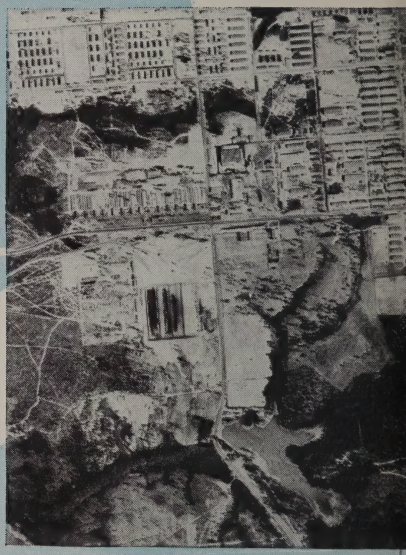
THE AERIAL VIEWPOINT AS IT AFFECTS CAMOUFLAGE

Camouflage affords protection against aerial inspection which includes direct observation by the trained observer and recording by photography. The aerial viewpoint is therefore of vital concern to those responsible for protective concealment.

There is too often little opportunity to study any but major camouflage installations at first hand on photographs and from the reconnaissance plane. For this reason we are obliged to become familiar at second hand with the principles and nature of aerial observation. We must learn to judge the effectiveness of camouflage against aerial observation by the appearance of an installation as we see it on the ground. When little time and few materials are available, we should know how much has to be done to gain concealment from the type of observation most likely to be employed against us.

FIGURE 2.—*The bombardier is an army's deadly foe. To confuse and mislead his keen eye and precision instruments is camouflage's chief responsibility. Understanding the relation between the man in the plane and the terrain below is half the battle of concealment.*

In this war, aerial photographs are being studied constantly to determine the location of enemy installations with relation to landmarks and terrain features. These landmarks and terrain features serve to guide pilots and bombardiers to areas containing military installations and usually aid them in the approach run. Occasionally, an installation may be so well camouflaged that the bombardier must resort to guess bombing. To do this, he may estimate the distance from his objective to some landmark appearing on the photograph and on the ter-



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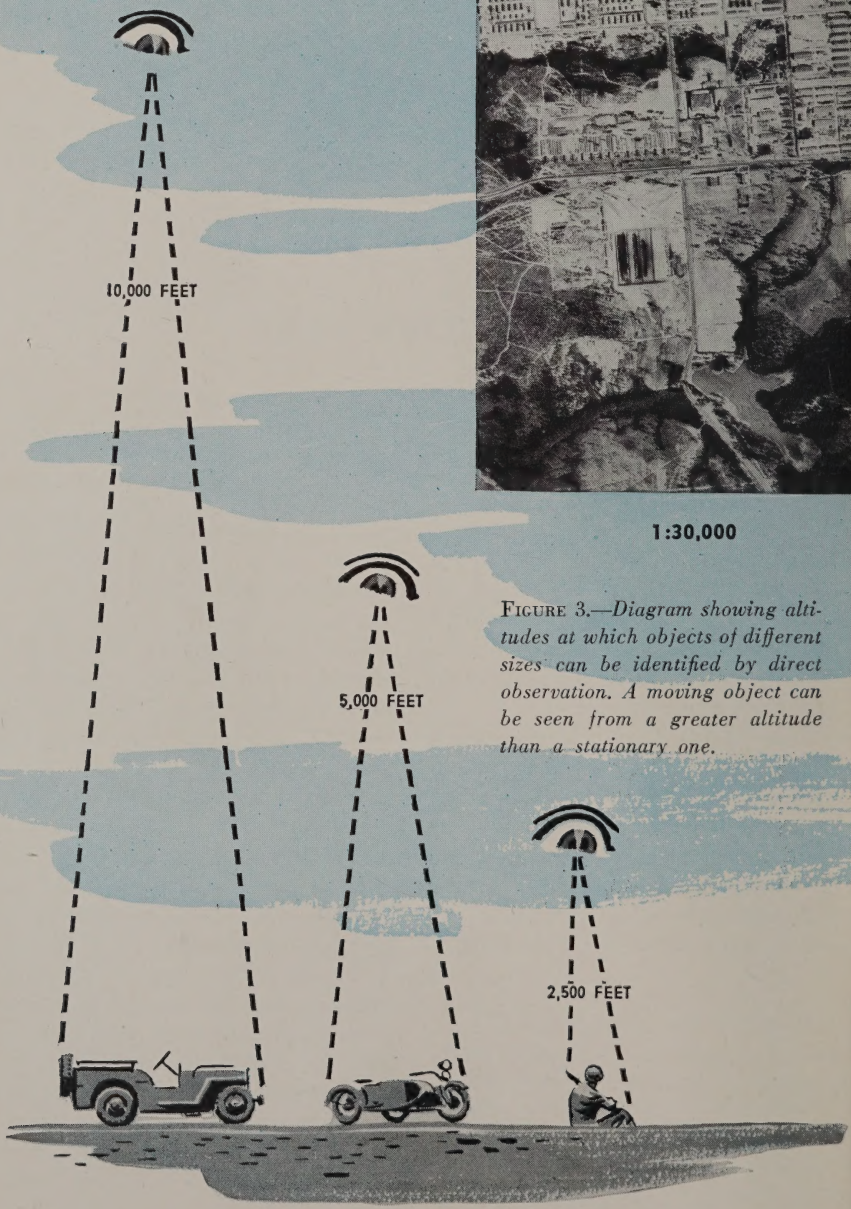

FIGURE 3.—*Diagram showing altitudes at which objects of different sizes can be identified by direct observation. A moving object can be seen from a greater altitude than a stationary one.*

FIGURE 4. (1), (2) and (3).—*Terrain photographs of army post taken from three altitudes. Comparison of identical features in views will give reader a good idea of how much detail can be seen at these altitudes and scales.*

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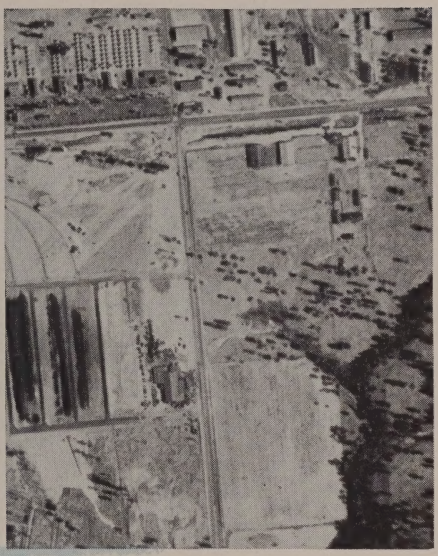


1:10,000

rain below him, and release his load at the proper time by judging distance on the ground or calculating a specific time interval. Such bombing, however, is likely to be inaccurate at best.

Aerial photographs are also used in determining missions for field artillery. Once spotted on a photograph, military installations may be accurately located on firing maps. The artillery takes care of the installation from there on. Aerial observation is often used by the artillery to check the accuracy of fire, which is then corrected from information furnished by these aerial OP's.

Valuable information about a whole proposed theater of operations may be gained by studying aerial photographs. Often the entire area is photographed at high altitude, and a mosaic (composite of many photographs) is made up at a scale covering the area. These mosaics play an important part in supplying information about a proposed theater; they help in planning the coming campaign. In later stages, examination of photographs of a bombed installation may yield valuable data for follow-up raids.

These are some of the ways in which aerial photographs and visual observation are being used in this war.

II

A plane at 30,000 feet is seldom distinguishable from the ground. Yet in the plane a mounted camera of 12-inch focal length from lens to film

may be making a permanent record of the terrain and of objects in that terrain. The scale of a photograph taken from such a plane at this elevation would be 1:30,000. (The scale is determined by the ratio between the focal length of the camera and the altitude of the plane.) On the photograph, skilled interpreters would be able to identify objects with horizontal dimensions as small as 25 to 30 feet.

Photographs of this sort can be "blown up" or enlarged to three times the original size. The scale would then become 1:10,000. Objects with horizontal dimensions of as little as 8 feet could then be identified. Those responsible for camouflage must realize that improved devices have made it possible to enlarge photographs of particularly high quality to as much as *ten* times original size.

The best way to become familiar with the power of the camera is to have aerial photographs of your own installations taken at various altitudes —for example at 1,000, 5,000, and 10,000 feet. If possible, these photographs should be prepared during training, and everyone who worked on the installation should be given an opportunity to study them.

III

Three kinds of film are used in this war. Each has its value and its limitations.

Normal-type (panchromatic) film photographs in all the shades of gray

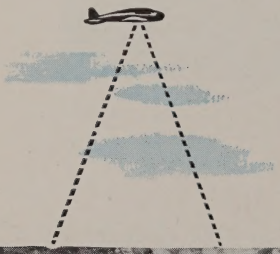


FIGURE 5.—*The aerial camera is far keener at picking up details of terrain—and, more important, of military installations—than is the eye. This vertical photograph represents normal type of aerial view—the kind on which camouflage installations must be unnoticed.*

from white to black. It can be used up to the serviceable altitudes of airplanes. By employing various filters, usable photographs can be obtained with this film even when considerable ground haze exists, provided the haze is fog and not smoke. (Smoke virtually prevents taking usable photographs with film of any type.)

Infrared film also registers in various shades of gray; but the number of infrared rays reflected by an object determines the shade in which it will register on the film. Deciduous trees reflect many rays, for example, and register in light tones on infrared film. Most artificial materials reflect few rays and register in dark tones. The film is therefore of value in detecting ordinary camouflage installations, although infrared-reflecting camouflage paints may be used on artificial materials to lessen the chance of detection by this form of photography. Infrared film also records through a great deal of haze. However, it is slower than panchromatic film and tends to "fuzz" at low altitudes.

Color film records in virtually the true colors. New developments in color film have made it possible to use it under reasonable atmospheric conditions up to the serviceable altitudes of planes. Experienced aerial photographers find combinations of filters that permit color photography even though considerable ground haze (fog and not smoke) exists. Color photographs of an area give more de-

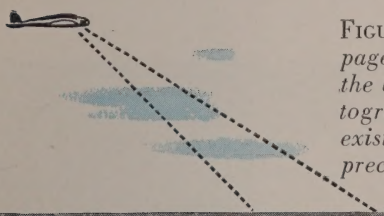
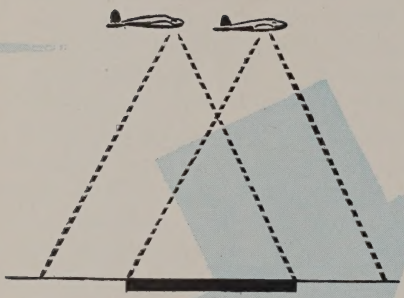


FIGURE 6.—*The terrain pictured on opposite page is shown here from an oblique angle—the bomber's view. Close study of the two photographs by a skilled interpreter will reveal existing military installations—unless proper precautions were taken against both views.*

tail than panchromatic photographs at the same altitude. Camouflage against aerial color photography is therefore the most difficult; the camouflage must be correct in every detail.

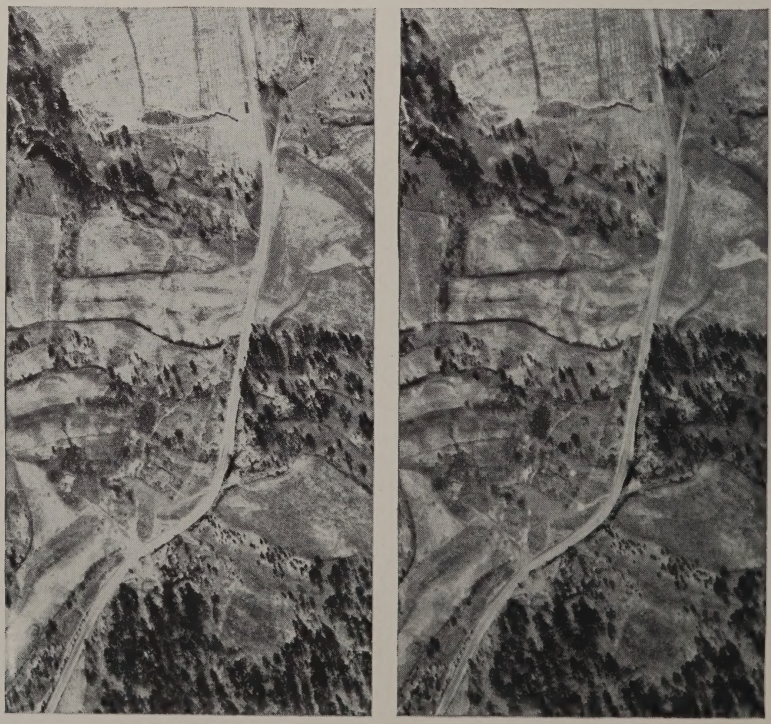
FIGURE 7.



IV

The time at which a photograph is taken is another important consideration. The long, merging shadows of early morning and late afternoon make detection of camouflage installations more difficult. The ideal reconnaissance time is around noon. Night photography, using flash bombs for light, is now common. The danger of enemy attack on photographic planes is minimized at night and troops are most apt to disregard camouflage discipline at that time.

FIGURE 8.—*A stereopair of an area showing a hilltop. In a stereoscope, the hilltop and exaggerated tree heights will be apparent.*



Although an aerial photograph records in two dimensions only, it is possible to simulate a third dimension by viewing overlapping pairs of photographs of the same area, made at the same altitude but at different stages of the plane's flight. When laid side by side, a pair may be viewed directly or through a stereoscope; the third dimension (height) then becomes apparent. This dimension is exaggerated. Therefore it is an essential principle to keep camouflage construction as close to the ground as possible to prevent detection on aerial photographs.

The power of the aerial photograph may be further extended by the practice of "flipping." An area to be studied is photographed each day for several days. Then, by stacking these

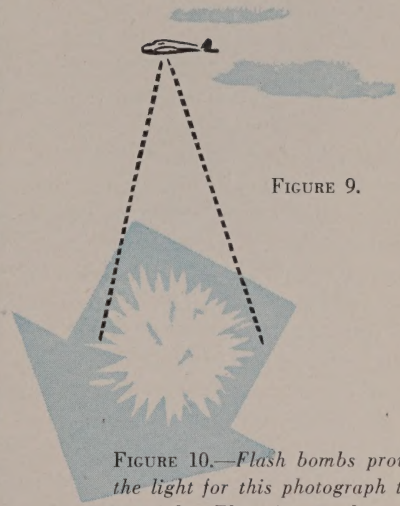
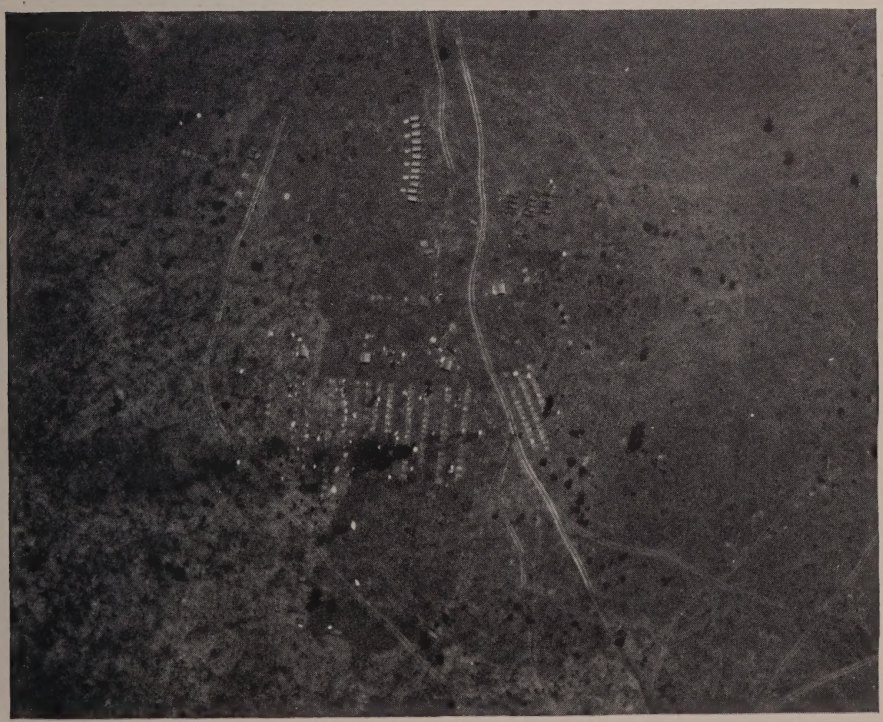


FIGURE 9.

FIGURE 10.—*Flash bombs provided the light for this photograph taken at night. The picture shows how little concealment darkness gives.*



progress photographs, holding them firmly in one hand, and flipping through them rapidly by pressing the thumb against their edges, the interpreter watches for a flicker in the image, such as is seen on a motion picture film. This betrays any slight change that may have been made from day to day.

Detailed studies of inspected areas are made. To set up a methodical routine for studying a photograph and to insure that all portions are given full attention, a mask may be used to restrict the area observed at any one time. The mask, a piece of paper or cardboard with a small hole in it, is moved across the photograph so that the interpreter studies the entire surface methodically. Suspected areas are given further study with stereopairs and by flipping, whenever suitable photographs are available.

Interpreters identify military installations and other objects by form, by associated features, and by activity or changes in terrain. Form is determined by size, shape, shadow, texture, tone, and shine. Associated features include tracks, spoil, excavations, trash, and relationship to other objects and landmarks. Camouflage work must recognize these points.

V

In a recent campaign, one of our air forces relied primarily on visual aerial observation for reconnaissance. The power of visual observation from the air, as well as its limitations, should be understood by those responsible for camouflage.

The eye is not as keen at recording details as the camera. However, pilots, bombardiers, and observers develop unusual ability to see and identify smaller details on the ground.

Objects and military installations

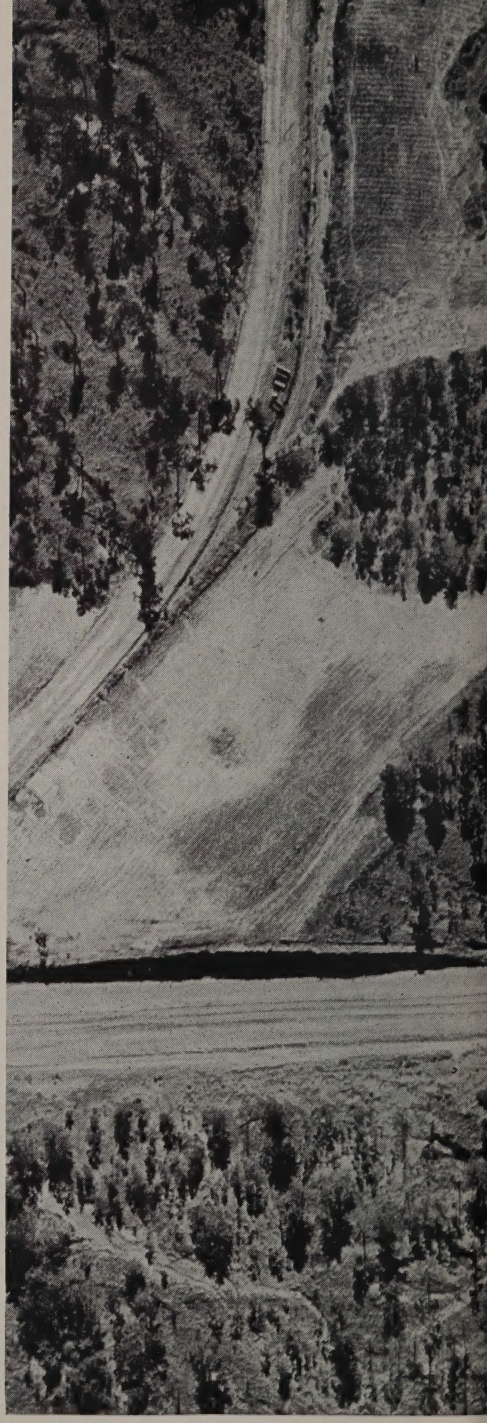


FIGURE 11.—*A black and white photograph with insert of the same area as it appears on color film. Color film gives more detail at the same altitude than ordinary film. Camouflage against color photography is thus more difficult.*

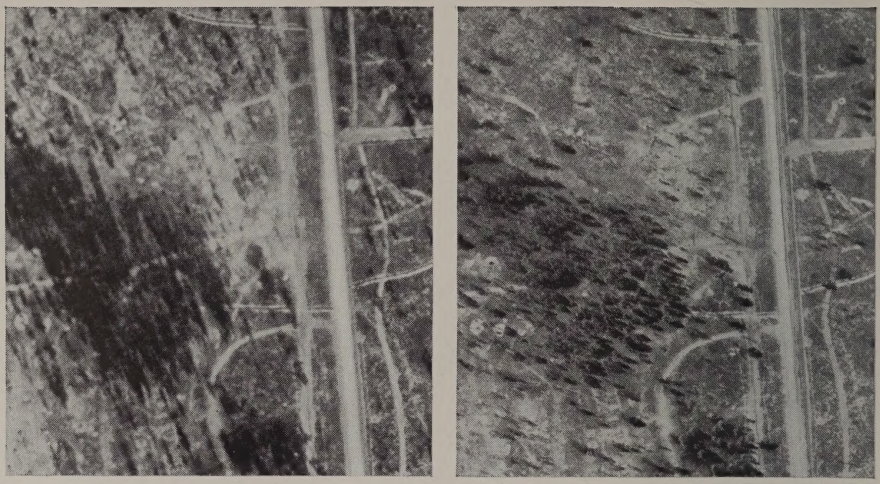


FIGURE 12. ① and ②.—*Infrared and normal type photographs of same terrain taken from same altitude. The number of infrared rays reflected by an object determines the shade in which it will register on the infrared photograph (left).*

FIGURE 13.—*Color photograph from high altitude. (Taken at 30,000 feet with 24-inch focal length camera.) Color values tend to diminish on color photographs as altitude increases. Compare this picture with Figure 11, taken at low altitude.*

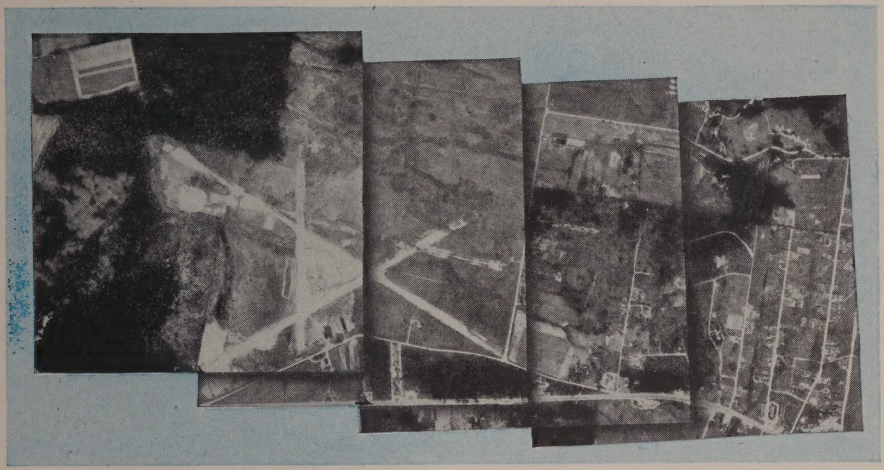


FIGURE 14.—*A mosaic is made by matching overlapping aerial photographs. The mosaic shown above illustrates how this is done with photographs depicting an airfield, with terrain pattern at one end of the field.*

FIGURE 15.—*Showing how trenches and foxholes in terrain are emphasized by their size and shape—two revealing factors.*

FIGURE 16.—*This vertical photograph illustrates how form is emphasized by shadow. Trees themselves are barely discernible.*

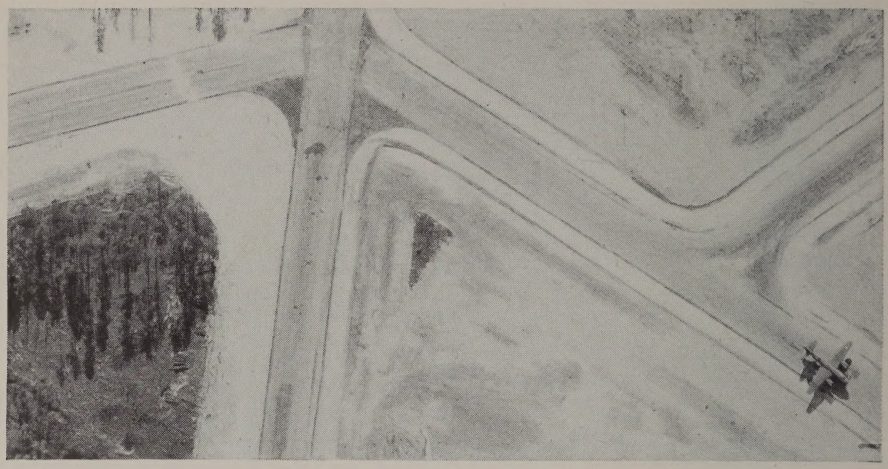


FIGURE 17.—*Features of an airfield in process of construction are emphasized by the variation of tone in this photograph. Barren earth, taxiway, area covered by grass, and area covered by trees all register in varying tones because of differences in texture. Note how smooth texture of barren earth and taxiways appears light, while rough texture of woods appears dark.*

FIGURE 18.—*Study of associated features reveals many facts about actual or suspected military installations. Note in this picture tracks, spoil, excavations, and trash, all of which are obvious indications of military occupation.*

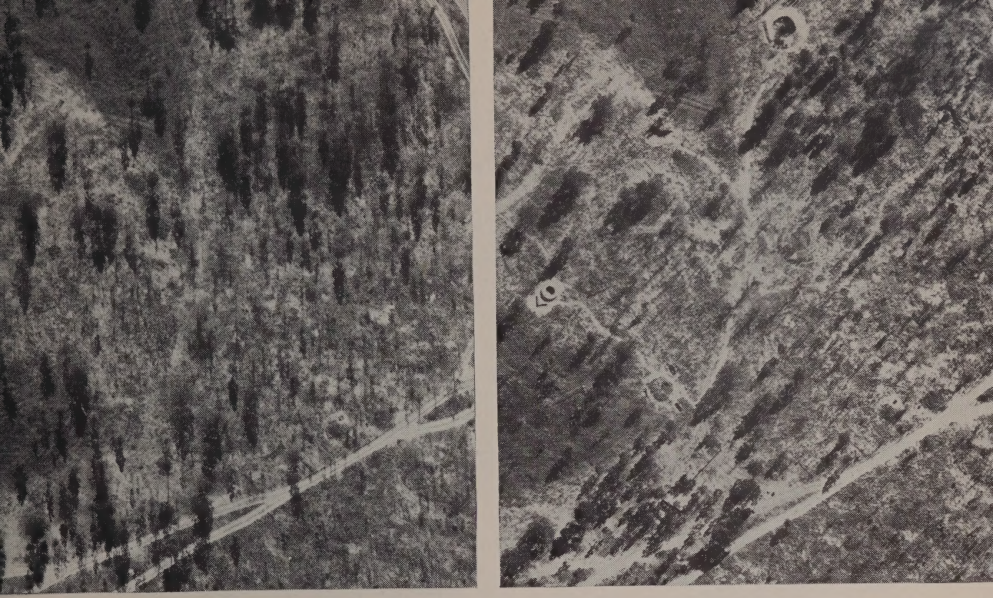


FIGURE 19. ① and ②.—*The photograph at left shows an area* before *siting of an antiaircraft battery. The picture of the same location at the right shows it* after *siting of antiaircraft battery and other signs of occupation. The need for camouflage is obvious.*

may be identified from the air by direct visual observation much as on the photograph, but the ability to perceive height or depth in small inequalities is lost at about 800 feet above the terrain. Color values diminish rapidly at altitudes of more than 10,000 feet because of atmospheric interference. Thus it is primarily the size of the object, taken in relation to the height of the observer above it, that determines whether or not it can be seen—provided of course that attention is directed to it. At 1,000 feet it is within the visual capacity of the eye to distinguish objects as small as 1 foot square; at 10,000 feet, objects of 10-foot dimensions; and so on. These limitations on visual observation necessarily vary considerably with atmospheric conditions.

VI

The aerial viewpoint is important to every soldier in this war. It is a basic requirement for successful camouflage practice. To grasp its possibilities, ask for photographs of the camouflage installations set up by your outfit. Remember the size of the installations. Ask for photographs at a scale that will enable you to see the installations easily. Ask also for a second set of photographs at a smaller scale that will make the installations more difficult to see. Infrared photographs and color photographs also are valuable if they can be obtained.

For example, if the installation includes objects 10 feet square, ask for a photograph at a scale of 1:5,000, and for one at a scale of 1:20,000. If the installation you want to study is a foxhole, ask for scales of 1:500 and 1:5,000. Remember that the scale of the photograph, the height of the visual observer above the ground, and the size of objects or details are prime considerations of visibility.

NORTH AFRICA AND THE MIDDLE

" . . . Again the mistakes made during maneuvers have been repeated on the battlefield, but now at the cost of lives instead of an 'assessment of casualties' by an umpire. . . . In areas where there is no natural cover reliance must be placed on dispersion. . . . Despite the lessons of years we still operate truck columns on roads in daylight, sometimes closed up, when the movement could have been made at night." *Memorandum from The Commanding General, Army Ground Forces.*

Notes received from two theaters in which troops of the United Nations are active indicate that once soldiers have been under fire they are more eager to use concealment.

Lack of camouflage discipline has disclosed many otherwise favorable positions to the enemy. An airplane flight over a forward airfield that was being subjected to enemy air attacks showed that the exact location of the field, which fitted into the pattern of its surroundings, was given away by a network of hard-packed tracks circulating around and over a low hill being used as a site for headquarters.

FIGURE 20.—*Decoy tanks were used to deceive the enemy.*

EAST

FIGURE 21.—*Soldiers digging in and getting cover from strafing planes in Africa.*

". . . In forward areas concealment was obtained generally by digging everything down to level of ground and covering with earth same color as surrounding ground."

". . . In some cases in desert operations, dug in emplacements are not camouflaged in an effort to make the position appear like a bomb crater."

". . . Ration cans and mess gear flashing in sunlight can be seen as far as 10 miles from the air. . . . Germans attack at noon because of this."

Middle East

NETS.—It was found that nets garnished without voids were best for desert use; less heavily garnished nets appeared too dark. Small-mesh woven fabrics similar to shrimp nets have been in great demand.

Flat-top nets have proved too conspicuous in most desert areas. Low, gradually mounded nets which return completely to the ground have been substituted.

DECEPTION.—In one instance infantry trucks and tanks made frequent trips into a holding-attack area under enemy observation. They returned by an unobserved route, choosing dusty tracks to suggest activity.

Occasionally dummy tanks have been placed behind the holding-force assembly areas and exposed to enemy observation. Real tanks moved around the dummies to enhance the effect.

DECOYS.—At one place a decoy railhead was constructed several miles from an existing railhead. Track was laid at normal mileage per day to make the operation appear realistic. On completion, a decoy train was erected on the track.

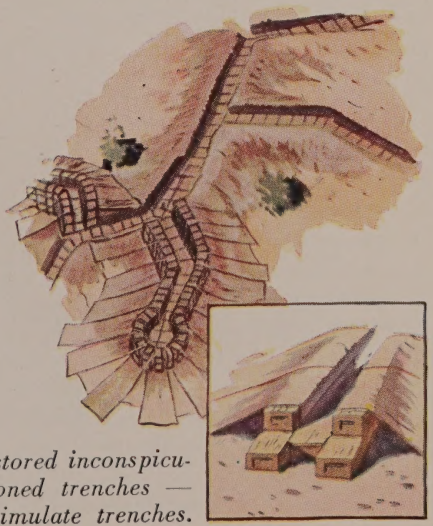


FIGURE 22.—*Boxes and crates stored inconspicuously against sides of abandoned trenches — also stacked and covered to simulate trenches.*

FIGURE 23.—*Class garnishing a net at a demonstration area.*

The eye is a better medium than the ear for transmitting knowledge of camouflage techniques. Seeing what someone else has done gives the average man a sharper, more convincing impression than merely hearing about it.

A look at an actual camouflage installation is easily worth half a dozen lectures. To show the soldier *what* has been done, and *how*, camouflage demonstration areas are being set up at many of our training centers. They present examples, arranged for easy inspection, of camouflage measures adapted to the terrain and likely to be useful to the units trained there. Such an area gives a soldier a chance to verify with his own eyes the methods discussed by the instructor. Practice areas are also provided, where he can carry out actual construction.

The demonstration area illustrated on pages 20 and 21 is suitable for training ground troops, including camouflage specialists. Detailed plans for its construction can be obtained from the Office of The Chief of Engineers.

Other suggested exhibits suitable for examination by ground troops are shown on pages 22 and 23. They emphasize simple camouflage techniques requiring a minimum of specialized materials and construction. It is important that in so far as possible theater of operations conditions be simulated and maximum use be made of improvisation and field expedients.

Air Force troops and Aviation Engineers will learn more from the demonstration area on pages 24 and 25. Plans for it may be obtained from the Office of The Chief of Engineers. Here exhibits are arranged to illus-

trate how camouflage techniques are applied to Air Force problems.

II

Four types of exhibit should be included in any camouflage demonstration area:

(1) The importance of careful choice of position and strict camouflage discipline is illustrated by the first type. These installations should be located in terrain affording the best possible natural concealment. All reflective surfaces should be covered and signs of activity in the area eliminated. No other camouflage measures are required.

(2) Exhibits of the second type, located in more open terrain, should use natural materials to supplement existing growth. This type can also be used to demonstrate that tracks and paths should be planned to pass along existing terrain lines and in the shadows of trees and bushes.

(3) The third type should show the employment of artificial camouflage materials to supplement natural concealment. Terrain where use of natural materials alone is impractical should be chosen for these installations. They should also demonstrate the extension of new paths to misleading objectives, such as other roads and paths, or decoy positions.

(4) Decoys and dummies comprise the fourth type. Emphasis should be placed on the simplest expedients,

FIGURE 24.—*Aerial photograph of a typical demonstration area. Each student should be given an aerial photograph of the exhibits he sees.*

FIGURE 25. — *Demonstration area for ground forces.*

Dumps:

1. Overhead screen over side-road dump. 2. Flat overhead cover over approach roads to dump. 3. Exposed stacks of ammunition boxes. 4. Exposed scattered ammunition boxes.

Large Artillery Positions:

5. and 6. 155-mm howitzer emplacement under flat-top. 7. Dummy 3" AA gun in decoy revetted position.

Small Weapons Emplacements and Support Points:

8. One 50-cal. MG emplacement under flat-top, natural materials. 9. One 30-cal. MG emplacement dug-in but in the open. 10. One 30-cal. MG emplacement under flat-top, artificial materials. 11. Road block, dummy pyramid type, concealed by lateral screen. 12. Mine field. 13. Observation post (dug-in type).

Dummies and Decoys:

14. Bushes. 15. Two-dimensional plane (dummy). 16. Rock or boulders. 17. Trees. 18. Dummy building over a dummy 50-cal. MG. 19. Dummy MG emplacement.

Artificial Materials:

20. Wire frame showing various types of garnish patterns (heavy and light) utilizing different artificial materials. 21. Flat-top over simulated P-40 fighter plane.

Natural Materials:

22. Sniper position behind boulders. 23. Sniper position in logs. 24. Echelon road screens. 25. Sniper position in bushes. 26. Sniper position in stump. 27. Path covered with overhead screen garnished with local natural materials.

Scouting and Patrolling Area:

Soldiers in camouflage suits—

28. In trees, 29. Behind log, 30. Behind stump, 31. In grass, 32. Behind boulders, 33. Behind fence post, 34. Behind mounds, 35. Behind bushes, and 36. Behind trees.

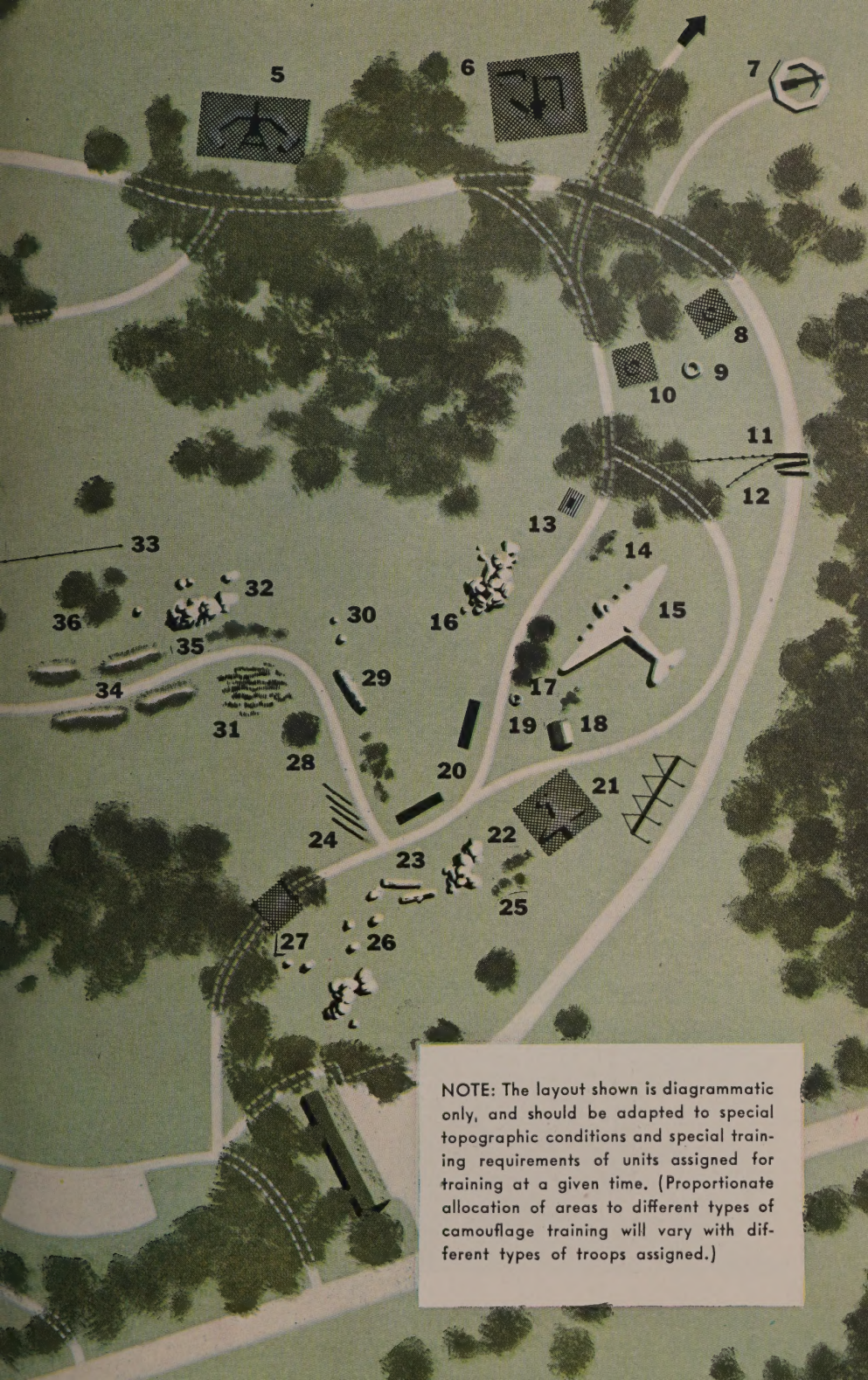
Vehicles:

Organic vehicular equipment parked as follows—

37. In open—undraped. 38. In open—draped. 39. In edge of woods—exposed parts draped. 40. In woods—undraped.

Bivouacs:

41. Water point. 42. Exposed laundry. 43. Dispersed tentage. 44. Taped paths and roads. 45. HQ tent. 46. Signs. 47. Latrine. 48. Exposed mess equipment. 49. Mobile kitchen. 50. Foxholes.



NOTE: The layout shown is diagrammatic only, and should be adapted to special topographic conditions and special training requirements of units assigned for training at a given time. (Proportionate allocation of areas to different types of camouflage training will vary with different types of troops assigned.)

FIGURE 26. — *This typical exhibit for a camouflage demonstration area consists of a 105-mm howitzer sited so that existing natural concealment provides necessary protection from enemy eyes.*

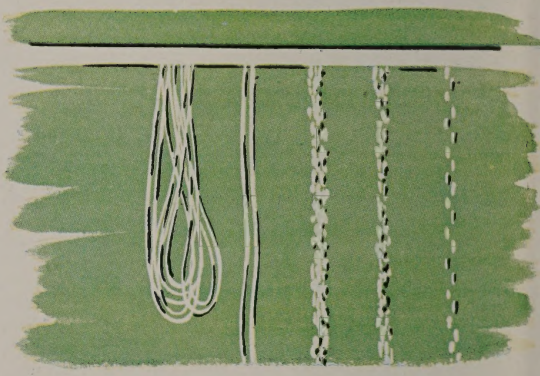


FIGURE 27.—*Tracks of men and vehicles make up this typical demonstration area exhibit. An enlarged aerial photograph of the exhibit should be displayed so that every student can compare ground and aerial views.*

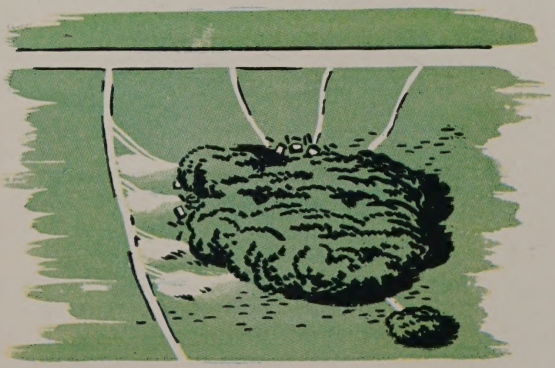


FIGURE 28.—*In this demonstration area exhibit, a decoy field artillery position, consisting of tracks, simulated blast marks, and debris, illustrates how easy it is to construct effective decoy installations.*

such as false tracks, debris, and other signs of military activity. The exhibits should be designed to show how to make effective decoys quickly with available local materials — or with none at all. The need for simulating activity at the decoy site by adding new tracks and debris from time to time also should be stressed.

Camouflage demonstration areas exist only to train troops in methods needed when they face the enemy. Time and materials must not be wasted in constructing gadgets.

III

Demonstration areas supplement other basic instruction in camouflage methods and practice. In groups of about twenty, students should be taken through these areas by instructors who will explain the exhibits and answer questions. When classes are of battalion size, an instructor can be stationed at each exhibit. One member of each student group is then designated to conduct the group from one exhibit to another.

Under ideal conditions, students should be flown over the area to observe the effectiveness of the exhibits as seen from the air. Otherwise each student should be provided with an aerial photograph at a scale of about 1:2,000. Enlarged photographs can also be displayed at critical exhibits.

Some form of written and graded test is desirable. Problems of camouflage technique or discipline may be used, or the students may complete sketches of the exhibits. Practical construction work is also done. In this way visits to a demonstration area become more than sightseeing tours.

FIGURE 30.—*Sketch above is used by the student, who indicates with an X the point at which persons in vehicles leave the highway, and then marks with a broken line the path to be followed on foot to the battalion command post.*

FIGURE 29.—*Machine gun and crew are concealed under draped fish net to make up this exhibit. Note use of a branch to raise the front edge of the net when the gun is fired.*

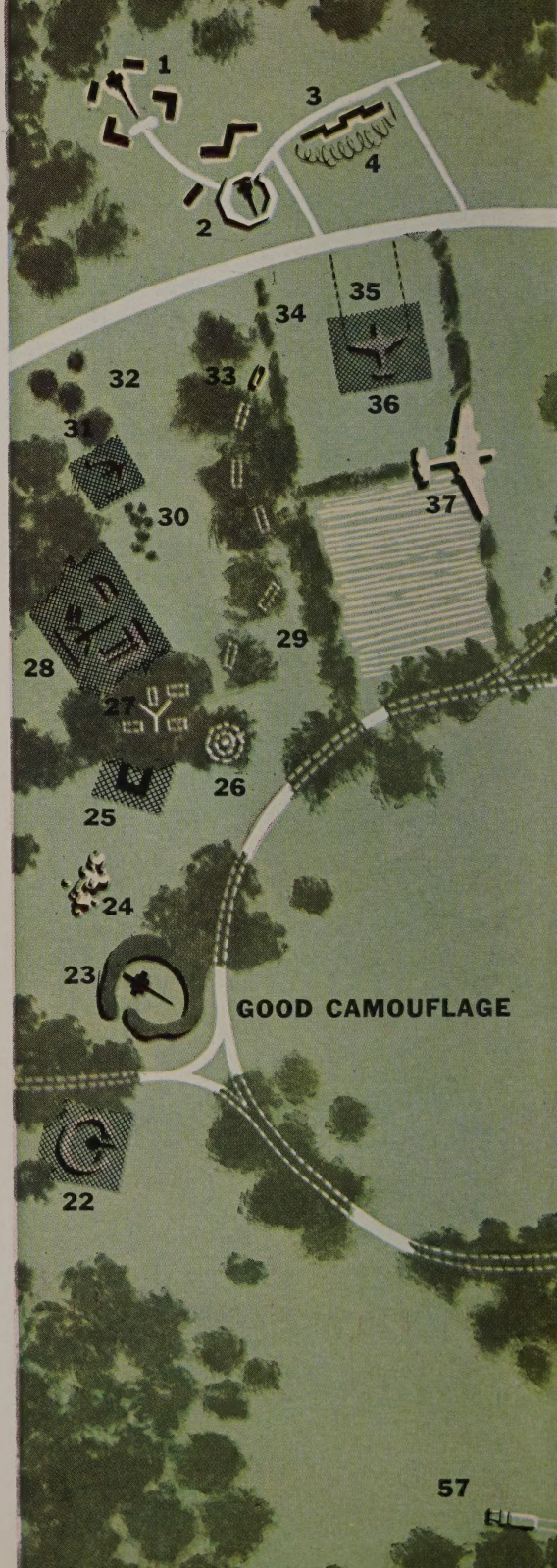
FIGURE 31. — *Demonstration area for air forces and attached troops.*

BAD CAMOUFLAGE:

1. Foxholes in open.
2. AA gun in open.
3. Trenches in open.
4. Exposed barbed wire.
5. Sagging flat-top.
6. Dummy bomber badly sited.
7. New paths in open.
8. Taxiway, untreated.
9. Poor garnishing.
10. Exposed mess kits.
11. Tents sited in open.
12. Exposed laundry.
13. Communication line badly sited.
14. Building badly sited.
15. Supplies in open.
16. Ammunition in open.
17. Vehicle parked in open.
18. Tracks disclosing vehicle.
19. Draped vehicle with tracks.
20. Vehicle draped tightly.
21. Undraped vehicle.

GOOD CAMOUFLAGE:

22. Flat-top for AA gun.
23. AA gun in revetment.
24. Dummy rocks.
25. Flat-top for 50-cal. MG.
26. Decoy MG emplacement.
27. 30-cal. MG emplacement.
28. Flat-top for heavy AA gun.
29. Foxholes.
30. Dummy bushes.
31. Flat-top for MG emplacement.
32. Dummy trees.
33. OP.
34. Obstacles.
35. Terrace flat-top.
36. Dummy bomber.
37. Dummy bomber.
38. Communication lines.
39. Dummy plane in hangar.
40. Taxiway, camouflaged.
41. Dummy bomber in woods.
42. Drape over plane.
43. Dummy tents.
44. Dummy building.
45. Taped or wired paths.
46. Vehicle correctly parked.
47. Mobile kitchen.
48. Latrine.
49. Vehicle under trees.
50. Vehicle partly draped.
51. DP with revetment.
52. Draped vehicle.
53. Vehicle dug in and draped.
54. Supplies stacked to simulate trees or buildings.
55. Vehicles parked in shadow.
56. Vehicles parked along hedges.
57. New roads correctly sited.



NOTE: The layout shown is to be considered diagrammatic only and should be adapted to fit special topographic conditions and special training requirements. Existing facilities should be utilized whenever possible.

How to insure concealment as quickly and with as little labor as possible is one of the vital problems at an advanced airdrome. Seldom do conditions permit spending much time on elaborate camouflage schemes. Yet, if the maximum efficiency of air units is to be maintained, some camouflage measures must be taken.

AIRDROME CAMOUFLAGE

in Theaters of Operations

FIGURE 32.—*Japs tried to camouflage this Guadalcanal airfield by continuing old, and introducing new, ground lines with paint, but field is in one of few large open spaces on island and near an S-like bend in river, making camouflage virtually impossible.*

FIGURE 33. (1) and (2).—*At left is a permanent flat-top over a P-40. Movable ramps eliminate tracks. Circle in picture at right shows installation taken at 500 feet.*

"It was my practice to sit in the cockpit all day on the alert," a combat pilot from the Southwest Pacific reports. "No more than 50 seconds after the alert signal I was on my way out of the dispersal position and by the time the Jap planes arrived I was at an altitude of 20,000 feet, waiting for them.

"For work like that, only very temporary concealment is needed, such as drapes of natural materials. The first job of the morning for my crew chief was to change the natural materials used to conceal the planes. Half-tops and flat-tops were reserved for planes needing repair, and for those covering the landings of the

FIGURE 34. (1) and (2).—*Hasty drape over this P-39 is made of ungarnished fish net covered with natural materials. Circle in picture at right, taken at 1,000 feet, contains installation.*

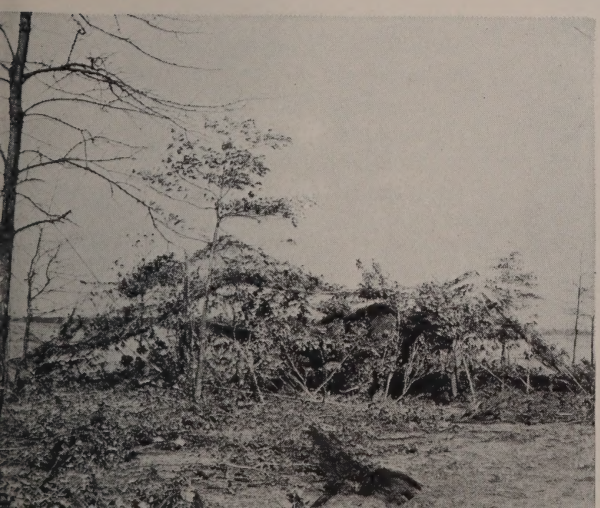


FIGURE 35.—*In this photograph of an ammunition dispersal area, melting snow has revealed bomb pens. Concealment could be achieved through use of nets.*

first-flight planes after their gas is exhausted.

"The present tendency there is to abandon texturing runways and taxiways, except at rear bases. Emphasis is laid on the concealment of planes, equipment, and personnel. Bomb damage is repaired quickly by the Engineers."

Another officer, a Marine from the same theater, who commanded a forward-echelon fighter squadron, stated, in reviewing the work necessary in the preparation of advanced island airdromes:

"Camouflage has to be kept in mind at all times. Submarines were quite active around the islands and they forced us to site our runways far enough inland so that they could not be seen from the water. Bivouac was established about half a mile from the field. Dispersion was practiced in the layout of bivouac areas, ammunition dumps, etc. Camouflage discipline was carefully maintained. We made regular aerial checks of the location both during construction and after the fields were in operation, to make certain we had not overlooked a chance to reduce or eliminate all signs of our presence.

"Our fields were difficult to see from the air from any but one or two

FIGURE 36.—*What to do with personnel housing is answered by dispersing buildings and painting them in low, dull tones.*

FIGURE 37.—*When roads are narrow, trees can be wired together overhead.*

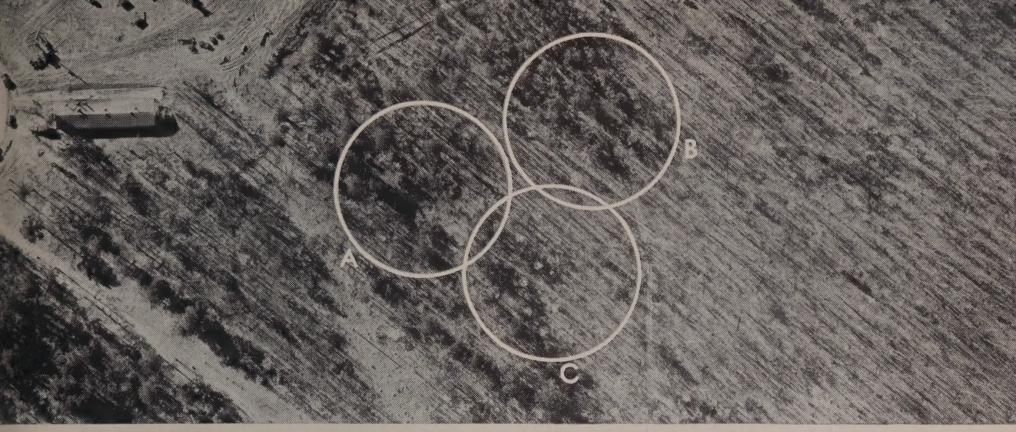


FIGURE 38.—*Many pieces of engineer equipment are concealed in this area.*

approach angles, even when the runways were extended to 7,000 feet. They were cut out of dense jungle. Cleared zones were kept to a minimum width. The topography of the islands and their dense blanket of tall palms were of tremendous advantage throughout our stay. Cutting of foliage anywhere on the island was forbidden except where it was essential to the construction of the runway.

"On one of the islands there was a rudimentary road system. We widened and improved it and the roads became the taxiways. Entering one of them was like entering a tunnel. They were perfectly concealed from the air by the overhanging coconut

FIGURE 40. — *Another in circle B.*

FIGURE 39. — *Bulldozer in circle A.*

FIGURE 41.—*A third one in circle C.*

palms, vines, and mahogany branches. Hard standings leading off the road system were widely dispersed, some a mile and a half from the start of the runway. Fighters were dispersed around the end of the field toward which the prevailing wind blew. The ready room, the assembly room of all pilots, was nearby. It had a direct telephone line to the Fighter Director Command control hut. This hut was heavily built of concrete, was separated from all other buildings, and was carefully camouflaged with paint, artificial materials, and transplanting."

One of the best devices for runway camouflage in the theater of operations is reported by an aerial observer who had the unusual experience of watching the Japs install it. He was in a reconnaissance plane flying over a Jap field when he saw a tree move. It marched right out into the middle of a clearing and sat there. Other trees followed. The plane circled to see what was up. Closer investigation revealed a runway newly constructed by the Japs. If the American plane had come over 10 minutes later, the pilot would not have recognized the field. When ground troops took the field a few weeks later, they found 30 dummy trees on skids. They had been towed on to the field and left in small groups on the runway. With the dummy trees in place the field looked like any of the other numerous natural, open patches in the jungle. No more than 20 minutes warning was needed to change the scenery.

Dummy trees are easy to improvise and can be moved rapidly. They are useful in almost any terrain. Few camouflage contrivances are as universally adaptable.

DISGUISE.—Conditions vary so greatly in theaters in different parts of the world that what might be a godsend to camouflage in China would be useless in Alaska. Great Britain and Germany have been involved in aerial warfare longer than other countries. Consequently, many different types of camouflage have been tried, although basic methods are substantially the same.

To a greater extent than in England, German airdromes are disguised as farms, factories, and villages. In some cases actual villages were taken over and their principal buildings used as aircraft shelters, repair shops, hangars, and administrative offices. The framework of these buildings is left intact. A church may serve as a hangar or a school as a barracks. Existing or new streets become taxiways. Often, where the runways are textured and painted to resemble pasture land, cows and sheep are turned loose to graze there when operations permit. In some cases, excellent camouflage has been effected by placing airdromes astride important highways, by diverting or covering streams, and by frequent use of unmarked landing strips in open country.

Many runways in both Great Britain and Germany are textured with wood chips; then patterns characteristic of the surrounding terrain are carried across them by ground painting. Under certain climatic conditions and at ordinary reconnaissance heights this treatment makes the field hard to identify. Some British turf fields are so successfully disguised that pilots familiar with them have difficulty in distinguishing them from their environment even at low altitudes.

DISPERSION.—To conserve agricultural acreage, dispersion of aircraft

is partially restricted on fields in Germany proper. In occupied countries, however, dispersed areas are exploited to the fullest extent. They sometimes cover an area of as much as 6 square miles. Aircraft are dispersed according to type. Bombers are kept far removed from the field and widely scattered, while fighters are allotted smaller areas near the edge. There is usually one such area for each *Staffel* of 9 to 12 planes. An airdrome at which a *Gruppe* (30 to 40 planes) is stationed normally has three or four dispersal areas, each with its own aircraft shelters, repair hangars, and storehouses for bombs, fuel, and ammunition. Stop-off and alternate escape airdromes, unoccupied until the day of an offensive, are used both for protection and for deception.

Key fighter airdromes are reinforced by satellite or auxiliary airfields located in the same neighborhood. These fields also function as extended dispersal areas and sometimes serve as decoys. It is believed that most of the *Luftwaffe's* fields along the French coast have satellites and that over 20,000 acres of land have been withdrawn from cultivation because of this program.

DECOY FIELDS.—Decoy airdromes are employed extensively by the British as well as by the Germans. Their operation in Great Britain is considered so important that camouflage officers are called C & D (concealment and decoy) engineers.

A decoy airdrome is a false representation of a real airdrome. Its main

FIGURE 42.—*This advanced airdrome has a single turf landing strip on which grass has been mown shorter than the rest of the field. This strip is prominent in the vertical photograph below, but airdrome as a whole would be difficult to pick out when observed from oblique angle.*

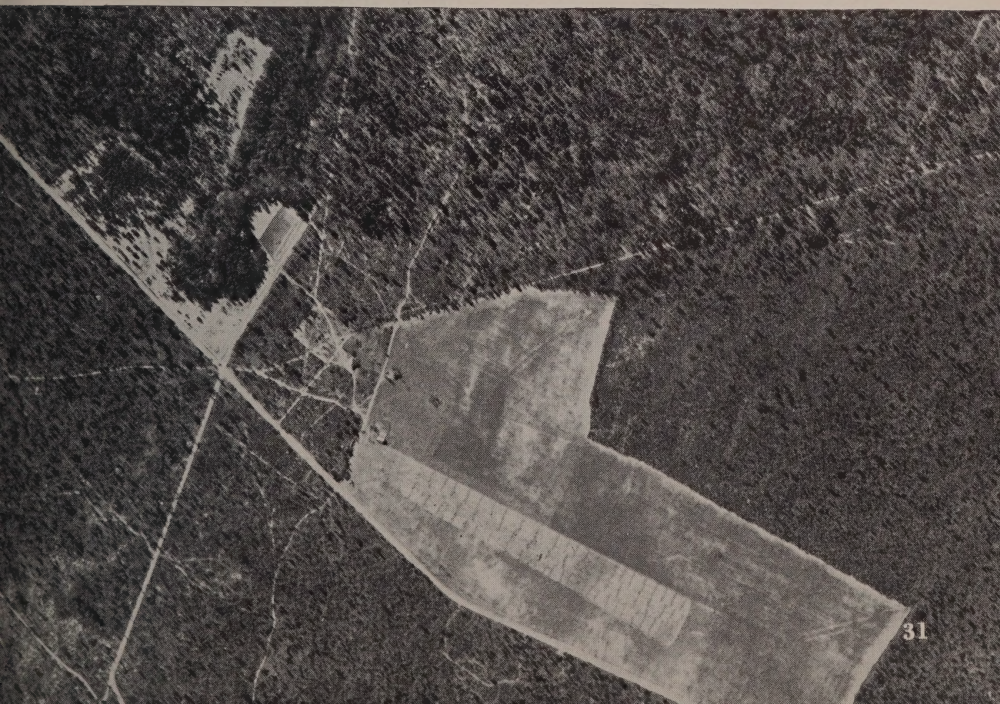


FIGURE 43.—*Dummy planes are visible on this decoy airdrome. The outline of the landing strip should be more clearly defined by mowing and by making obvious tracks.*

purpose is to divert air attacks from important targets. Although it must appear to be just as serviceable as the active field, it may or may not be usable for landing. Dummy construction simulates all or any portion of an airdrome and its facilities. The decoy is situated near enough to the real airdrome to draw attention intended for it, but not so close that fire directed at the decoy will result in damage to the true target. Two miles is about the minimum distance between airdromes and decoys.

In an area as congested as Great Britain and as often photographed, German aerial-photo interpreters soon learn to detect the difference between operational stations and decoy stations. The decoys may be identified on aerial photographs without much trouble because the small number of men stationed at a decoy field are not able to improvise as much muss, trample down as much grass, or reproduce the activity of the genuine field.

The British keep on using these fields, however, for the good reason that enemy planes continue to drop an impressive number of bombs on the decoys. It is far more difficult to distinguish between the real and the false from the air than from an aerial photograph. Under combat conditions, the enemy bombardier trying to recognize an objective is under a heavy strain. The strain is doubled when he has to make a choice between two confusingly similar targets, located within a few miles of each other on the map. Many times the enemy bombardier makes the wrong choice. At worst, the delay while he is making up his mind is of great assistance to the defense.

NIGHT DECOYS.—Climatic and topographical conditions in the Middle East are less favorable to camouflage than in Great Britain. The atmosphere is clearer, observation is easier, and the scarcity of natural ground concealment complicates the hiding of planes and facilities. In the Mediterranean theatre, nevertheless, British decoys have reached their peak development, perhaps because of the efforts made to overcome these handicaps.

Night decoys are the cheapest and most effective method of misleading the enemy, the British Middle East Command has found. They have been responsible for attacking planes dropping as many as 300 HE bombs on the wrong site in a single night.

To aid this process of deception, the RAF has recently combined its

mobile airdrome lighting system with the "Q" lighting set, so that the same set may serve either purpose. ("Q" lighting is decoy lighting, designed to mislead enemy aircraft.) The set is now in use in all British war theaters and has proved unusually effective in the desert. It simulates an imperfect blackout, leading the enemy to believe that an important objective is being disclosed. The exposed light pattern must have an outline exact enough to approximate reality, but it need simulate nothing more than a partly open door with a light shining through. The deception will not succeed unless the source of light behind the screen is itself screened.

Imagination and artifice are more important than equipment in creating this type of illusion. Airfields can be suggested by landing guide lights, barracks and technical buildings are simulated by a few false window lights, bivouacs by a kitchen fire or flashlights, and a dump or water point by false truck headlights.

FIGURE 44.—*Dummy trees made by cutting young evergreens close to the ground and mounting them on movable bases. Sprayed with paint, trees will retain their color.*

DECOY MAINTENANCE.—The maintenance of dummies of all kinds must be given careful attention. No matter how close a dummy comes to being a replica of the real thing, if it is poorly situated or left without the marks of human activity normally associated with it, it will not fulfill its mission as a decoy. Dummy aircraft must be moved from day to day, even from hour to hour, when under frequent enemy scrutiny. The same kind of attention must be paid to the other features of decoy airdromes. Unless they can be made to look as though they are really the base of continuing flight programs, the effort to prepare them is wasted.

The Russians go so far as to have one or two real planes on the field, which take off only when the enemy is near—if possible, only when he has manifested some interest in the airdrome.

DECOY PRINCIPLES.—From the foregoing it will be seen that this aspect of camouflage is a matter of shifting emphasis from one thing to another. It is a bag of tricks based on the principle that when big and little things compete for a man's attention, the big ones always win. A soldier will not hear a rifle crack when a 240-mm gun is being fired nearby.

What has all this to do with the camouflage of an airfield? Just this: the clearer your understanding of what goes on in the mind of a man

FIGURE 45.—*Tactical position of a 37-mm antiaircraft gun. Flattop folds to ground.*

FIGURE 46.—*The same gun position from above. Note blending of net with natural material.*

FIGURE 47.—*Power plant for an AA battery concealed beneath natural materials—a simple but effective example of camouflage.*

who is trying to see what you are trying to hide, the more easily you can deceive him. The stage magician knows that the eye is always attracted by movement. So while manipulating the cards with one hand he distracts your attention by waving the other.

The Russians used the same technique when they set up a dummy railroad train a couple of miles away from an airfield. From smoke pots in the engine, a cloud of smoke rose to the sky. German pilots bombed the sham train, but the airdrome completely escaped their notice. As soon as the bombs hit, the Russians set off more smoke pots, ignited electrically from a distance, to indicate a direct hit and to mask the true composition of the train. The next day German reconnaissance planes came over to find realistic dummy wreckage in place, and went home satisfied that another Russian supply train had been put out of the running.

Such tricks cannot be relied on to work everywhere. The story is included here to underscore the fact that camouflage planning for any installation should include the possibility of trickery on a grand scale.

FIGURE 48.—*A number of air-raid shelters are concealed in this vertical photograph.*

FIGURE 49.—*A close-up of one of the shelters shows how it is concealed from view.*

FIGURE 50.—*For specific kinds of terrain, soldiers improvise camouflage clothing. Here one soldier paints a three-color foliage pattern on another's green twill fatigue uniform. Paint should be thick and applied sparingly. If brush is not available, dauber can be improvised by rolling up a strip of burlap.*

FIGURE 51.

CAMOUFLAGE CLOTHING and the FIGHTING MAN

One of the weapons of a patient fighter is the camouflage suit. It is not meant for passive defense alone. It is meant to conceal fighting power, to conceal it long enough to provide an opening for the knockout blow, which hits the unsuspecting enemy where it hurts. And the suit conceals the source whence the blow came and may come again.

The camouflage suit doesn't make a man invisible simply because he wears it. But it does help to conceal the soldier who uses his head, who knows how to take position so that his suit will blend with the background.

If a soldier has been trained in individual concealment (see TM 5-267, page 15) he is ready to use the camouflage suit. To supplement his sharpened wits, the Army gives him a carefully worked-out disguise. A good deal of time has been spent in studying terrain, climates, and colors. Out of that study have come designs for several types of suit in different patterns for varying climates and terrain.

The **jungle suit** is a reversible, one-piece outfit, mottled in shades of green on one side, with the reverse side colored sand-tan. The sand-tan side is for wear on beaches, deserts, and in other sandy areas. Another specially designed outfit is the **snow suit,** a plain white two-piece suit designed to blend with snow.

Camouflage suits do not interfere with the soldier's freedom of movement. The pack, cartridge belt, canteen, and gas mask are ordinarily worn outside the suit. Such canvas articles can be pattern-painted by the individual soldier to resemble the pattern of his suit. (See TM 5-267, page 16.)

When the standard suit is not available, an improvised suit can be made in the field by painting ordinary herringbone fatigues in irregular splotches. The staining material may be a dye, any available paint, black crankcase drainings, or even a mixture of mud and cup grease.

If it is available, a 1-inch brush is recommended for daubing. But no special equipment is actually neces-

sary, as a good dauber is easily made by wrapping osnaburg strips or a handkerchief around the end of a stick. The pattern should be applied by one soldier while another wears the fatigues. Another method is to stamp the pattern on the cloth with a block of wood dipped in paint. Canvas equipment is painted similarly, and all paint should be allowed to dry for 24 hours.

A helmet cover is easily improvised. Cut a circular piece of osnaburg, burlap, or other cloth, 20 inches in diameter; then sew a 1-inch hem around the edge. Through the hem thread a tape or drawstring, and pull the cloth tightly over the helmet. Daub the cover to match the rest of the camouflage suit, and cut several 2-inch slots in the cover to allow insertion of leaves and twigs for further concealment.

Camouflage clothing is something more than an instrument of attack; it sets the soldier a lesson, an example. He will be more conscious of his background, and will be likely to maintain better camouflage discipline. The soldier doesn't have to depend on a manufactured suit. Once he has seen one he can make his own. The Russians and the Marines know that it works. It will help kill Germans and Japs. If each soldier learns how to use it, you will be able to ask him if it works; he will be alive to tell you about it.

FIGURE 52.—*Issue camouflage clothing for wear in snowy areas makes the soldier blend with his background—if the background is white, or is mottled with white. Fur should be turned inside, and gun painted white or wrapped with strips of white cloth.*

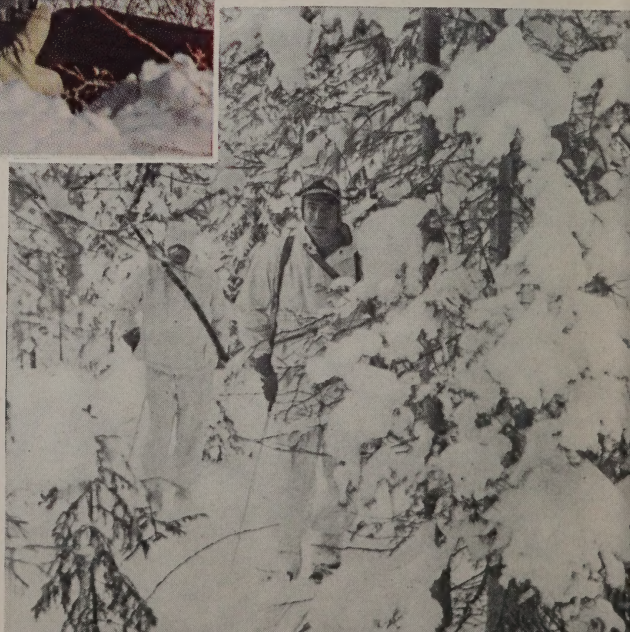
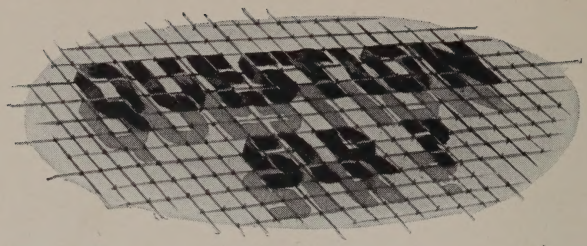


FIGURE 53.—*Camouflage suits must be used intelligently to be effective against winter backgrounds. Choose proper background, and do not make quick or needless movements.*

FIG. 54.—*Mottled pattern of the jungle suit and helmet cover merges with tropical backgrounds.*

FIGURE 55.



Should runways, materiel, or personnel receive first consideration in camouflage treatment of an airfield or air base?

Personnel and materiel first; runways, second. This is now standard practice in many theaters where it is easier to maintain runways under attack than to conceal them effectively.

What is a good way to conceal antitank mines in barren soil or on gravel roads?

Wrap the mines in paper or cloth to keep dirt out of the spider. Then place them with the spider down and the upper surface flush with the ground, or less than 1 inch below it. Cover the mine with the spoil and whatever surface material was there before. In hard ground the holes should be 16 to 18 inches in diameter at the top.

What is the difference between dummies and decoys?

A dummy is a simulation of any real object. It may or may not be used as a decoy. A decoy is an installation intended to draw the enemy's attention.

How long will oleoresinous paint last before it fades appreciably?

Fading becomes noticeable at a minimum of 3 months and appreciable at the end of 6 months.

Are terrain characteristics in the various theaters of operation considered in distribution of GI camouflage materials?

Yes. They are provided for in manufacture. This is the responsibility of the theater supply officer with the advice of Army Service Forces and the Office of the Chief of Engineers.

Should the ends of garlands be tied into the net or allowed to hang down?

Usually they should be tied in. However, it is sometimes desirable to create a darker tone without increasing reflection from the surface of the camouflage net. In this case, ends of the garlands should hang free to create deeper shadows.

Should artillery flat-tops be flat in uneven terrain?

Yes—and parallel to the ground of the immediate areas where built.

[A.G. 062.11 (3-5-43).]

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